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RAPID TRANSIT SYSTEMS IN SIX METROPOLITAN AREAS

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FOREWORD

The following report on rapid transit systems in North America was prepared by Gunther M. Gottfeld, a candidate for the degree of master of arts in public administration at American University, while a student intern at the National Capital Planning Commission. It is published to make available background material of value in this committee's consideration of the transportation plan prepared by the National Capital Planning Commission and the National Capital Regional Planning Council.

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RAPID TRANSIT SYSTEMS IN NORTH AMERICA

INTRODUCTION

The following report is a reconnaissance survey of rapid transit systems in the United States and Canada. Included is an analysis of metropolitan transportation systems in New York, Chicago, Philadelphia, Boston, Cleveland, and Toronto. The analysis gives a geographic description of the metropolitan area, rapid transit and commuter railroad systems in each area, the effect rapid transit has had on land use, and an evaluation of the transportation system. A complete description is included for every rapid transit line outside of New York, including the length, type of equipment, frequency of service, type of areas served, feeder bus connections, parking facilities, and other pertinent information. Such complete information was not included for New York or for commuter railroad lines because they are not comparable to the rapid transit lines proposed for the Washington metropolitan area. The purpose of such lengthy detail in describing each rapid transit route is to make a comparison with rapid transit routes proposed for Washington.

CHAPTER I

NEW YORK METROPOLITAN AREA

Probably the largest metropolitan area in the world is the New York standard metropolitan area, which has a total population of about 15 million, and an area of 3,654 square miles. It comprises portions of three States—New York, New Jersey, and Connecticut. Of the 15 million total population of the area, about 8 million live in New York City and the other 7 million live in the balance of the metropolitan area.

New York City was the first capital of the United States of America, but not since 1790 has it served as the political headquarters of the Nation. Today New York City is the chief financial center of the country, and is also one of the most important seaports in the world. New York has become such an important port because its location at the mouth of the Hudson River made a magnificent harbor.

New York City is made up of five boroughs—Manhattan, Brooklyn, Bronx, Queens, and Richmond (Staten Island). Originally the five boroughs were independent cities, but in 1900 they were fused into New York City. The most important of these boroughs is, of course, Manhattan, where the bulk of the employment and tourist attraction is located. On a typical weekday in 1956, 3,300,000 persons entered the heart of Manhattan—the area south of 60th Street. Most of these people came from outside of Manhattan, including the Boroughs of Brooklyn and Queens, and Long Island to the east; the Borough of Bronx and Westchester County, N.Y., and Fairfield County, Conn., to the north; and Essex, Bergen, Morris, and Passaic Counties in New Jersey to the west. Because the Borough of Manhattan is an island, it was necessary to build tunnels, bridges, and subways connecting Manhattan with the other boroughs and New Jersey, as well as to establish a system of ferryboats between Manhattan and New Jersey. Manhattan was laid out on a gridiron street pattern, which has proven to be unsatisfactory because of the large amount of land devoted for streets, and the tendency for each street to be a major traffic artery.

Because New York City is more of a commercial than an industrial city, its central business district is extremely important. Although there has been a 10 percent decline in the number of people entering Manhattan since 1948 as a result of certain industries moving to New Jersey and some decentralization, there has been an extensive office building boom. More than 100 new skyscrapers have been erected in midtown Manhattan since 1947. The addition of these new office buildings has created a much more intensive peak period because of the greater concentration of employment. There seems to be no end to new office construction, as a number of rather tall buildings are currently underway.

The great bulk of the population in the New York area uses public transportation to get to work. As a matter of fact, the proportion of people entering Manhattan by automobile is probably smaller than for similar trips in any other city in this country.

For the purposes of this report, the description of public transportation facilities will be divided into two parts. The first will include the transit system within the city of New York, and the second part those transit systems originating outside of New York City.

The largest and most important transit operation in the New York metropolitan area is the New York City Transit Authority, a State-established, quasi-public agency charged with the responsibility of operating and constructing the rapid transit and surface bus system within the city of New York. The authority carries 4,500,000 people a day on its subways and another 1,500,000 people a day on its surface system. The total of 6 million people a day carried by the transit system is greater than for any other city in North America.

The backbone of the transit is the extensive network of subways. Before describing the importance of the subways it would be useful to look into the history of rapid transit in New York City.

Rapid transit in New York had its beginning in 1866, when a law was passed authorizing the construction of an elevated railroad operated by a "propelling cable" from a stationary engine. This was the beginning of New York's "el" system, which was quite extensive until its replacement by subways during the past several decades. Elevated railroads were quite prominent on Second, Third, Sixth, and Ninth Avenues in Manhattan, as well as on several lines in Brooklyn. Today only the Myrtle Avenue elevated in Brooklyn remains of the once extensive system, although a number of the subway routes do operate on elevated structure on the outer portions, particularly in the Bronx and in Queens. There were a number of reasons for discontinuing the elevated routes. Perhaps most important was the blighting effect they had on adjacent property. The structures were very dingy, the trains were extremely noisy, and much light was shut off underneath. The structures were quite old, having been built in the 19th century, and needing extensive rehabilitation. The last elevated line in Manhattan, the Third Avenue route, was discontinued in 1955 after it was decided not to spend $80 million to modernize the structure and equipment.

Construction of the first subway began on March 24, 1900, in front of City Hall. The first section of this subway, known as the Interboro Rapid Transit or IRT, was completed in 1904 from City Hall to Broadway and 145th Street. Extension of the subway system to Brooklyn, Bronx, and Queens soon followed. The Brooklyn-Manhattan Transit or BMT system in Brooklyn entered the subway field in 1913 when a short loop line was placed in operation. In 1924 the Board of Transportation of the City of New York was created to construct and operate an "independent" system. Ground was broken in April 1925 and service commenced on September 10, 1932, on the Washington Heights-East New York line. Extensions to the subway system have taken place since 1932, but in recent years there has been a trend away from subway construction because of increasing costs. The Second Avenue subway, which was to replace the Third Avenue elevated, has never been started. Anticipated to cost $500 million in

1950 when work was scheduled to begin, the latest estimate pushes the price tag close to $1 billion. It appears very unlikely that the Second Avenue subway will ever become a reality.

The most recent rapid transit extension was completed in June 1956 to the Rockaways in the outer parts of Queens. The new route, which cost about $51 million, utilizes the tracks of the abandoned Rockaway division of the Long Island Railroad, which discontinued service over this spur in 1950 as a result of a fire that destroyed a large trestle.

The IRT and BMT transit systems were acquired by the city in 1940 for $317,291,932 and were unified with the Independent (IND) System into the New York City Transit System. In 1955 the New York City Transit Authority was established to replace the NYCTS because the latter had become too involved in politics. The new authority placed control of the transit system into a State agency which was theoretically removed from city politics.

The New York City Transit Authority operates 6,600 rapid transit cars over 237 miles of track and more than 2,000 buses over 533 miles of city streets. There are 269 subway stations, 195 elevated stations, and 22 open-cut stations, or a total of 486 rapid transit stations.

The subway system has experienced a 31 percent decline in ridership since 1948, when 6,500,000 passengers were carried on an average weekday. Considering only the passengers riding to the heart of Manhattan, the weekday number declined from 2,389,000 to 1,970,000. Most of this decline has taken place during the off-peak hours and on weekdays, although the reduction of 50,000 jobs in downtown Manhattan has also had an effect on rush-hour travel. The greatest decrease is from the Borough of Brooklyn. The change in the type of employment in Manhattan from industrial to office is largely responsible for this change. The only increase has been from the Borough of Queens.

The breakdown of riding for 1957 can be summarized as follows:

Revenue passengers

BMT	239,170,143
IRT	489,507,488
IND	395,566,594
Divisional free transfer	189,648,250
Rockaway	3,138,193
High school fares	18,689,673
Elementary school	3,569,600
Total rapid transit	1,339,379,941
Bus and trolley coach	415,239,957
Total system	1,754,619,898

Passengers entering heaviest stations

Station	1957	Weekday (estimated)
Times Square, BMT-IRT	39, 417, 472	127, 000
Grand Central, IRT	39, 137, 017	126, 000
34th and 6th Avenue, BMT-IND	34, 556, 851	101, 000
Union Square, BMT-IRT	23, 106, 899	74, 000
Pennsylvania Station, IRT	22, 582, 481	73, 000
Fulton-Broadway-William, BMT	21, 212, 689	68, 000
42d and 8th Avenue, IND	19, 803, 392	64, 000
34th and 8th Avenue, IND	18, 901, 872	61, 000
50th and 6th Avenue, IND	14, 525, 011	47, 000
59th Street Columbus Circle, IND	13, 875, 310	45. 000

Source: Statistical Guide for New York City. Weekday estimate by Gunther M. Gottfeld.

The New York subway system is the most extensive in the world, and serves both an express and a local function. Express service is operated on all major routes from Manhattan to the other boroughs. Express trains average about 28 miles per hour, and stations are spaced 1 to 2 miles apart in the express section. At the outer portions, the routes become local subways stopping at all stations. The local lines operate in the same subways as the express trains, but on separate tracks. They perform a short-haul function, similar to that of a local bus. Many passengers transfer from express to local trains to reach their destination.

Despite some decline in riding, the peak hour volume on certain routes still exceeds 100,000 passengers an hour.

In addition to the New York City Transit Authority, there are a number of privately owned bus companies which carry over 1 million riders a day in New York, mostly short-haul riders in Manhattan.

In 1956 some 370,000 persons came to Manhattan from outside of New York City between 7 and 10 a.m. on weekdays. Of this number, 151,000 came from New Jersey on the west; 132,000 from Long Island on the east; and 87,000 from Westchester County, N.Y., and Fairfield County, Conn., on the north. The distribution by mode of travel was as follows:

	Rail		Bus		Auto	
	Number	Percent	Number	Percent	Number	Percent
New Jersey	75,000	50	48,000	32	28,000	18
Long Island	74,000	56	6,000	5	52,000	39
Westchester and Fairfield Counties	59,000	68	9,000	10	19,000	22
Total by mode	208,000	56	63,000	17	99,000	27

Source: New York Times.

Although trans-Hudson commuting from New Jersey still represents the largest volume coming into Manhattan from outside of New York City, the absolute number has declined from 161,000 in 1925 to 151,000 in 1956. The number coming in by commuter train has declined much more drastically from 154,000 in 1930 to 75,000 in 1956. Automobiles and motorbuses have replaced most of the former rail patronage. Expanded industralization in New Jersey will probably continue to reduce trans-Hudson commuting to Manhattan. Most of the rail commuting is handled by four carriers: Pennsylvania,

Lackawanna, Jersey Central, and Erie Railroads. Only the Pennsylvania has direct access into Manhattan. The other three roads require transferring at Jersey City or Hoboken to ferries or Hudson and Manhattan subway trains. The time and inconvenience required for transferring is an important reason for the 51 percent decline in train patronage since 1925. The motorbuses, which have replaced many of the trains, provide direct service to the Port of New York Authority Bus Terminal in midtown Manhattan. The equipment used by the four railroads leaves much to be desired. Most of the cars are more than 30 years old and quite uncomfortable for the large number of people who must spend over 1 hour commuting. The Pennsylvania and Lackawanna use overhead electrified multiple-unit cars in trains up to 10 cars. The Erie and Jersey Central are dieselized.

The second largest suburban commuting area is Long Island. The principal commuting mode is the Long Island Rail Road, which in recent years has been the only rail carrier to have had an increase in traffic. In 1930 the road carried 47,600 commuters to Manhattan on an average weekday, and today the figure is about 74,000. The 50-percent increase since 1930 is due to the very substantial growth of Long Island. Since Long Island is mostly residential, there do not exist the large employment centers to attract workers that are present in New Jersey. Other reasons for the increase in riding on the Long Island, in contrast to the Jersey roads, are an extensive modernization program which has included the purchase of several hundred new commuter cars, and direct service to Pennsylvania Station in downtown Manhattan. The Long Island is mostly an electrified third-rail operation, although the outer parts of some routes are dieselized. With the continued growth of Long Island, it is reasonable to assume that riding will continue to increase.

The third commuting area is from Westchester County, N.Y., and Fairfield County, Conn., to the north. The two rail carriers are the New York Central and New York, New Haven & Hartford Railroads. These two roads carry 59,000 commuters to Grand Central Station every weekday. There has been a very slight increase in riding since 1930, not to be compared with that of the Long Island Railroad. The area served by the two railroads is largely high-income residential. The equipment varies from relatively new to very old. Both railroads have purchased several hundred new cars since the end of World War II. The New York Central is electrified third rail, and the New Haven electrified overhead catenary.

The New York metropolitan area has the most complex subway and commuter railroad system in the world. It is an indispensable part of the economy of the region, and without it New York City would not be the great city that it is today. However, commuting conditions are far from satisfactory. Rush-hour conditions on the subway system are deplorable. Despite the addition of over 2,000 new subway cars since 1946, thousands of people must be jammed into cars like cattle during the rush hours. The commuter railroad situation is not as bad as far as crowding is concerned, but much of the equipment is old and uncomfortable, traveling times are frequently

more than 1 hour, and transferring is often necessary to reach one's destination.

There does not appear to be any single solution to the rail commuting problem. The very fact that many people must spend over 1 hour to commute is in itself very undesirable, no matter how modern the equipment may be. The continued purchase of new subway cars will improve subway riding to some degree, particularly in the off-peak hours, but subway congestion cannot be relieved unless additional subways such as the one proposed under Second Avenue are built. Unfortunately, the cost of this would be almost prohibitive. The 10-percent decline in total movement to Manhattan has not decreased the congestion problem, because the development of high-rise office buildings has intensified the peak hour problem as a result of greater concentration of employment.

CHAPTER II

CHICAGO METROPOLITAN AREA

Chicago is the second largest metropolitan area in North America. Over 6 million people live in the 3,654 square miles classified by the Census Bureau as the Chicago standard metropolitan area. Almost 4 million people live in the city of Chicago.

Chicago is basically an industrial city, located at the southwestern tip of Lake Michigan. The chief industries include printing and publishing, railroad equipment, meat products, iron and steel products, and agricultural machinery.

Although Chicago is an industrial city, there is a great deal of commercial activity in the central business district. The Loop, which is the term used to describe the core of Chicago, attracts some 850,000 people each weekday. Most of these people work in large office buildings, particularly along Michigan Avenue. The Merchandise Mart, largest private office building in the world, employs about 30,000 people.

Rapid transit and commuter railroads carry 67 percent of the peak hour movement to the Loop. Only 16 percent enter by private automobile. Yet the congestion caused by this small percentage of auto traffic is almost unbelievable.

Again it will be desirable to analyze the rapid transit system separately from the commuter railroads.

Rapid transit facilities were operated by the privately owned Chicago Rapid Transit Co. until 1947. Until that year surface bus and streetcar lines were operated by the Chicago Surface Lines, also a private company. On October 1, 1947, the Chicago Transit Authority, a quasi-public body created by the Illinois Legislature, was established to provide public transportation in Chicago and parts of Cook County. The Chicago Transit Authority took over all operations of the predecessor Chicago Rapid Transit Co. and Chicago Surface Lines, and integrated the two systems. The two private companies had competed with each other and there was a complete lack of coordination between rapid transit and surface facilities. The rapid transit physical plant was in deplorable condition. Over 1,100 cars were of wood construction dating back to the 1890's, stations were in disrepair and badly in need of paint, stations were too close together (averaging two blocks apart on some lines), and transferring from a rapid transit train to a bus was almost unheard of.

Today the Chicago Transit Authority is an integrated transit system serving the city of Chicago and several suburbs to the north and west. About 2 million passengers are carried on an average weekday on the entire system. About 560,000 people a day ride the rapid transit lines. Transferring from rapid transit to bus lines is now very common, and this has increased the usefulness of the rapid transit system substantially.

CTA operates about 1,100 rapid transit cars, 2,600 motorbuses, and 600 electric trolley coaches, a total of 4,300 vehicles. Of the 1,100 rapid transit cars, 774 are postwar lightweight cars. All major rapid transit routes have some of the newer cars except the Lake Street line; and the north-south and Congress routes are exclusively equipped with this equipment.

A brief history of rapid transit in Chicago would be in order at this point. The second largest American city has had a long and intimate association with rail rapid transit service—so much so that its central business district is nicknamed the Loop after the elevated railway that encircles it. Beginning in 1892, elevated lines were constructed throughout the city and adjacent suburbs until 1930, when the last elevated extension was completed. Attention was then focused on subways. The first subway under State Street was opened in 1943 and the second subway under Milwaukee Avenue and Dearborn Street was finished in 1951. In 1958 the Congress Street rapid transit project was opened, which represented the first example of center mall rapid transit in an expressway in this country.

Since CTA began operating rapid transit in 1947 many improvements have been made to the system. In addition to the 774 new cars, many lightly used stations have been discontinued, an A and B skip-stop system has been inaugurated on all major routes reducing the number of stops almost in half outside of the Loop, stations have been repainted, and provisions have been made for transferring to buses and trolley coaches.

A brief description will now be given of the rapid transit routes in Chicago:

North-south.—This is the basic north-south transit route in Chicago. It is the longest and most heavily traveled route in the city, measuring 20 miles and carrying about 300,000 people a day. Service is provided every 2 minutes in the rush hours with eight-car trains, and every 4 minutes during the base period with six-car trains. The A and B skip-stop service is provided on the route at all times except nights and Sundays. Trains begin at Howard Street (northern boundary of Chicago) and parallel Lake Michigan for most of the route. There are two branches at the southern end, in which A trains turn west on 63d Street to Englewood and B trains go east to Jackson Park. The route is elevated embankment for 4 miles, elevated structure for 4 miles, subway for 5 miles, and elevated structure for the remainder of the route to the two southern terminals. Fares are collected at stations at all times. The route serves a large apartment area on the North Side and a densely populated substandard residential and commercial area on the South Side.

West-northwest.—This is a new rapid transit route combining three former routes. It is the second busiest route, carrying about 140,000 people a day, and consists of A trains operating between Logan Square in northwest Chicago and Des Plaines Avenue in suburban Forest Park, and B trains operating between Logan Square and Cicero. Service is provided every 3 minutes on the combined portions, and every 6 minutes on each of the western branches. During the rush hours six-car trains are used. The rest of the day two-car trains suffice. The route is elevated from Logan Square for about 2 miles, then in subway for 4 miles passing through the Loop area, and

then in the median strip of the Congress Street Expressway for 6 miles to Laramie Avenue. At this point the expressway operation ends and the remaining 2¾ miles are on a temporary surface right-of-way with many grade crossings to Des Plaines Avenue in Forest Park. Construction is now underway for locating the remaining portion of the route on the superhighway, and this is expected to be completed in 1960. The Douglas Park branch which operates to Cicero shares the Congress Expressway tracks for about 1 mile from the downtown subway portal and diverges on a special ramp leading from the expressway to the elevated structure. The remainder of the Douglas route is elevated structure, except for the last 1½ miles, which are on the surface with numerous grade crossings. Conductors collect fares at many stations during the offpeak hours, except in the subway where fares are collected at stations at all times. The A and B skip-stop system is operated, skipping a few stations on the Logan Square portion of the route. There is no skip-stop system employed on the expressway operation because the frequency of service is not sufficient to warrant it. The area served by the Logan Square portion is average residential of older vintage. The western section is mainly old residential for the inner portion of the Congress route and the entire Douglas route, and suburban residential for the outer part of the Congress route. The distance betwene Logan Square and each of the western terminals is about 15 miles.

Lake Street.—This is CTA's major west side rapid transit route, 10 miles long, and carrying about 60,000 people a day. Service is provided with six-car trains every 2 minutes in the rush hours and two-car trains every 5 minutes in the middle of the day. The A and B skip-stop service is operated at all times except nights and Sundays. Fares are collected by conductors at most stations on the route except during the rush hours when cashiers are on duty. Trains operate on elevated structure around the Loop and on Lake Street to Laramie Avenue, where they shift to surface right-of-way on the north side of Lake Street for the remaining 2½ miles to Forest Park terminal. The surface operation is quite hazardous, as there are 22 grade crossings. Work is now underway on relocating the surface part of the route on the adjacent elevated embankment of the Chicago & North Western Railroad. When this is completed late in 1962, modern lightweight cars will replace the present equipment, which dates back to 1924. Unlike most Chicago rapid transit routes which receive current from an electrified third rail, overhead trolley wire is used for the surface operation. When the elevation is completed, third rail will supplant the overhead trolley operation. The Lake Street line is very similar to a commuter railroad because most of the riding originates in the outer portion of the route in suburban Oak Park and western Chicago. There is relatively little riding in the inner portion of the line and stations are very far apart. The nature of the route is suburban residential in the outer portion and old residential in the inner part.

Ravenwood.—A major rapid transit route serves northwest Chicago, measuring 10½ miles, and carrying about 50,000 people a day. Service is provided with 6-car trains every 3 minutes in the rush hours, and 2-car trains every 7 minutes in the middle of the day. An A and B skip-stop service is provided during the morning and evening rush hours on weekdays. Fares are collected by conductors at most sta-

tions except during the rush hours when cashiers are on duty. The route is elevated structure, except for the last mile which is surface operation with several grade crossings. The route serves an older, but well kept, residential area.

Evanston.—This is basically a suburban line, resembling a commuter railroad. During most of the day it is a 4-mile shuttle running from the Howard Street terminal of the north-south route to the suburb of Wilmette. During the rush hours through service is operated from Wilmette to the Chicago Loop via the elevated structure. Fares are collected by conductors at all times. There is a 13-cent suburban zone north of Howard Street, thus making a fare of 38 cents (25 cents city and 13 cents suburban fare). There is, however, a reduced token rate selling for 35 cents. The route is elevated embankment north of Howard Street, except for the last one-quarter mile which is surface operation with a few grade crossings.

Overhead trolley connection is used instead of third rail because of a city ordinance in Evanston prohibiting third rail. Service is provided every 5 minutes with four-car trains in the rush hours, and every 10 minutes with two-car trains during the day. The Evanston line serves a very fashionable section on the north shore through Evanston and Wilmette. Most of the 9,000 daily riders travel during the morning and evening rush hours.

The following table gives a breakdown of the riding volume of rapid transit lines in Chicago in 1959:

	Maximum p.m. peak volume	Total weekday average
North-south	28,000 north 28,000 south	300,000
West-northwest (Congress route)	11,000 west 10,000 northwest	140,000
Lake Street	12,000 west	60,000
Ravenswood	14,000 north	50,000
Evanston	4,000 north	9,000
Total		559,000

Source: Chicago Transit Authority.

The peak volumes are for the maximum peak period. This does not usually represent a 1-hour period, but the figures are based on the number of people which would be carried in an hour if the peak period lasted for 60 minutes. It is the peak period which a rapid transit system must be designed to handle.

On June 22, 1958, the Chicago Transit Authority commenced operation of the Congress Street Expressway rapid transit route. The inauguration of rapid transit on this route opened a new era in public transportation in metropolitan areas because it was the first instance in which rail rapid transit was incorporated in the median strip of an expressway.

The physical setting of the Congress Expressway is a 10-mile long 330-foot-wide ditch, cutting through a broad swath of some of the most heavily built-up real estate on the continent. The sides of the ditch slope at an average 30 degrees down to the two four-lane highways on either side of the median strip, which varies from 79 to 120 feet in width throughout the length of the roadway.

Although the new rapid transit route is a two-track facility, there is room for two more tracks from the subway portal at Halsted Street to Kenton Avenue (4¾ miles) and one more track from Kenton Avenue to the outer terminal at Des Plaines Avenue (3¾ miles). The additional trackage may eventually be used to bring the Lake Street elevated, lying three-quarters of a mile to the north over this faster route, and also to provide express service.

The Congress rapid transit route is not actually a new route, but replaces an elevated line which had operated for over 50 years. A substantial portion of this elevated route, known as the Garfield Park line, was in the path of the expressway right-of-way. It was a very unattractive structure and would have been even more unsightly if it had been left in the right-of-way because it would have risen even higher because of the depressed character of the expressway. To have retained the elevated structure would have complicated construction of the roadway and would have required the expenditure of a substantial sum of money for necessary reinforcement throughout its length. In view of these considerations and in exchange for easements through CTA property as required by the expressway, the highway authorities agreed to give CTA a right-of-way in the median strip and to prepare it for the installation of a rapid transit facility. Basically, it was a matter of exchanging rights-of-way between CTA and the highway agency.

For CTA it meant removing from the expressway right-of-way at its own expense the stations, shops, and existing elevated structure not needed for continued operation of its local service.

For the city of Chicago it meant building a temporary rapid transit facility in Van Buren Street (street adjacent to the expressway) in order to maintain service and constructing with funds other than motor-fuel tax funds new trackage, stations, and appurtenant facilities in the median strip when it was completed.

For city, county, and State highway builders in this section of the expressway it meant using additional highway funds to prepare for the median strip facility. These additional funds amounted to less than 5 percent of the total cost of the expressway.

The rush hour capacity of the eight-lane Congress Expressway has been estimated at 1,500 vehicles per lane per hour. Assuming an average of 1.5 persons per car, the total capacity of the expressway is about 9,000 or 10,000 passengers per hour one way. Estimated capacity of the two rapid transit tracks is 40,000 passengers per hour each way, four times that of the eight lanes of the expressways. At the present time the highway facility is approaching its theoretical capacity of about 6,000 cars per hour, but the rapid transit which presently carries about 11,000 passengers per hour is operating at slightly more than one-fourth of its carrying capacity. CTA could easily increase the capacity by running 8 or 10 car trains on more frequent headways. A recent survey shows that about 12 percent of the riders on the Congress rapid transit formerly drove their automobiles. Thus the rapid transit facility has shifted some auto traffic from the expressway.

At present, only the initial 6 miles of the rapid transit facility is completed. The remaining section from Laramie Avenue to the Des Plaines terminal will be completed in 1960. The outer portion of the route will leave the median strip by means of twin subway tubes which

curve south under the east roadway. The tracks will be located south of the expressway from this point out instead of in the median strip. In addition to CTA tracks, the expressway project also includes the relocation of Baltimore & Ohio and Chicago Terminal Railroad tracks, which will be located immediately adjacent to the rapid transit tracks. At Des Plaines Avenue the rapid transit tracks will cross back over the expressway to enter the new terminal, which will be on the north side of the expressway.

Overall, the 9½-mile length of the West Side Subway (official name of the Congress rapid transit route) looks like this: the first three-quarters of a mile (from Dearborn Street to Halsted Street) is an underground subway; the new 5¾ miles (from Halsted to Laramie) is in the median of the expressway; and the last 2¾ miles (from Laramie to Des Plaines terminal in Forest Park) is on depressed right-of-way just south of the expressway.

The initial section of the rapid transit operation (from Dearborn to Laramie) was constructed by the city of Chicago for $23,500,000 from highway funds and subway bonds. Highway funds were used to provide the right-of-way, excavation, grading and drainage, and ballast for the rail facilities in the median strip, as well as to increase the length of local street overpass bridges. The subway bonds financed the subway portals and the tunnels connecting with the Milwaukee-Dearborn subway, the rapid transit stations (located at the overpasses every 0.7 mile), stairs and passageways, and items of fixed transportation equipment. The cost of the three-quarter mile subway from Dearborn to Halsted was $12 million, and is to be repaid by CTA to the city in monthly installments over a 30-year period.

The remaining section of the rapid transit route, from Laramie Avenue to the terminal at Des Plaines Avenue, is being built by county and State highway funds. The cost of this section, including temporary relocations but excluding the new terminal at Des Plaines, is about $7,100,000. The new terminal will be built and paid for by the city of Chicago.

It is expected that the Congress Street rapid transit facility will stimulate the development of high-rise office and apartment buildings along the route to replace the present slum property. Such development is expected particularly near the rapid transit stations.

Three more combined highway-rapid transit projects have been proposed for the Chicago metropolitan area: the northwest expressway, the south expressway, and the southwest expressway. Funds for the preliminary work on these projects (planning, engineering, and the construction of certain necessary transit items) are being made available from a $10 million city of Chicago bond issue. To date, only the northwest expressway is under construction, and provision for median strip rapid transit is already well underway.

In the northwest expressway the situation is much different with regard to the financing of the transit facility than it was in the Congress Expressway. In the latter route, the rapid transit operation was an existing utility operating in and owning right-of-way in the proposed path of the expressway. For this reason highway funds bore a substantial share of the cost of the rapid transit relocation and new construction made necessary by the building of the roadway. In the northwest expressway, since no rapid transit facility ever existed

there, it is not a question of relocating an existing utility, but of incorporating a new rapid transit line in the center of a brand-new highway. The justification of including the rapid transit is based on the highway engineers' attitude that 300 to 400 feet for right-of-way are necessary, about the size of a city block. Buying the entire block costs little if anything more than buying almost the entire block because there are always heavy damages to pay on any small pieces of property remaining in the block. So the cost of the basic transit right-of-way in the median strip is practically nil. Another advantage in buying the whole block is that it is possible to use the two adjacent streets on each side of the block for frontage streets along the new expressway. This saves money and simplifies entrance and exit roads for the expressway.

The cost of including rapid transit in the northwest expressway will be considerably higher than it was for the Congress Expressway. The estimated cost of the rapid transit fixed facilities, excluding the rolling stock and the subway connection, was about $1,500,000 per mile. In the northwest expressway this cost will be $2,700,000 per mile, or almost twice as much. This difference in cost is due primarily to the fact that the Congress Expressway is depressed throughout its length, while the northwest expressway is depressed about half its length and elevated on an embankment the other half. While this was desirable from the viewpoint of the highway builders, it meant that for a 3-mile section the highway required bridges, retaining walls, and other fixtures over local roads. The extra costs of building these structures for the median strip transit facility must be paid by the city as part of the cost of the fixed rapid transit facilities. The median strip will be built to accommodate rapid transit all the way to the new O'Hare Airport, even though the initial operation will probably terminate at or near the Chicago city limits.

The Bureau of Public Roads has approved the use of Federal funds to finance the extra-wide median strip of the northwest expressway, and it appears likely they will do so for the south and southwest expressways.

The extension of rapid transit service on the northwest expressway will mark the first real rapid transit extension in Chicago in almost 30 years. To date, the new subways and median strip routes have replaced elevated facilities which had existed for many years. The northwest route will require a 1-mile connection between the existing Logan Square elevated structure and the northwest expressway. Estimated cost of the entire project is $31 million, plus $7,500,000 for equipment. If the financial resources are made available this year by the State of Illinois for rapid transit construction, it is possible that operation of trains on the superhighway may begin in about 3 or 4 years.

The South Side route will traverse through some of the most densely populated area in Chicago. Although still in the planning stage, construction is expected to get underway very soon. The present north-south route will be connected to the south expressway by extending the present State Street subway from Roosevelt Road to about 30th Street (a distance of 1½ miles). South of 30th Street the route will be in the median strip of the expressway to 103d Street on the Calumet branch, and to the city limits and 119th Street on the Blue Island branch. The present Englewood part of the north-

south rapid transit route will be connected at about 59th Street. The Jackson Park branch of this rapid transit line will continue using the present elevated structure as a local service, but would encircle downtown on the elevated loop instead of entering the State Street subway. Although rapid transit on this expressway is further into the future than the northwest expressway, CTA has asked for State aid to finance the initial portions of the rapid transit work. Estimated cost is $31,750,000, plus $12,750,000 for equipment.

The fourth route which will have median strip transit operation is the southwest expressway. In this route it was decided to use buses because the anticipated volumes are not heavy enough to justify rail operation. It is proposed to construct exclusive bus lanes in the median trip of the southwest expressway from about Halsted Street near the Loop to Cicero Avenue in southwest Chicago. Operation of transit on this route is still many years in the future, as construction of the expressway has not yet begun. Estimated cost is $7 million, plus $630,000 for buses.

In addition to the median strip extensions, the Chicago Transit Authority is making improvements to the existing rapid transit lines. Construction has recently begun on elevating the outer 2½-mile ground-level section of the Lake Street rapid transit route between Laramie Avenue and Harlem Avenue by using the paralleling, grade-separated elevated embankment of the Chicago & North Western Railroad. Five public agencies are sharing the construction costs, estimated to be $4 million. The State of Illinois is contributing $1 million; village of Oak Park, $800,000; city of Chicago, $600,000; county of Cook, $1 million; and Chicago Transit Authority, $600,000. The construction will involve the building of a ramp connecting the Lake Street elevated tracks with those of the North Western Railroad, moving of railroad tracks to the north, and constructing five rapid transit stations. Removal of the ground-level operation will also permit the removal of surface tracks and the widening of Lake Street, a major thoroughfare in Cook County.

A major part of CTA's proposed improvement program is the installation of block signal and train control facilities which are urgently needed to improve the safety of rapid transit operations. A major portion of CTA's rapid transit system lacks these safety features, and there have been several severe accidents in recent years. The predecessor Chicago Rapid Transit Co. was ordered to install these facilities as long ago as 1935, but funds have never been available. Estimated cost is $28 million. CTA this year asked the State of Illinois for funds to finance part of the signaling.

Extensive "Park-'n-ride" facilities are planned at major rapid transit stations, including most of the present and proposed terminals. At the present time there are only a few hundred parking spaces at four terminal locations.

Essential to the safety of operations and improved travel time is the elimination of sharp curves on the elevated right-of-way. There are 31 sharp curves where the speed potential of modern cars cannot be used. At some locations speed is restricted to 10 miles per hour. Estimated cost of this important plan is $6,400,000.

Although there has been a 10 percent overall decline since 1948 in the number of persons entering and leaving the Loop each day, the

number of people leaving the Loop during the maximum hour on rapid transit has increased 12 percent from about 67,000 in 1948 to 75,000 in 1957. Conversely, during the same period the number of people leaving on surface buses and streetcars declined 51 percent from 73,000 to 36,000.

In evaluating the quality of transit service in Chicago, one finds that the Chicago Transit Authority has made extensive improvements to its rapid transit system since it took over these facilities from the private company in 1947. Many new cars have been purchased, all of the old and dangerous wooden cars have been replaced, the new Congress Street rapid transit has been completed, many lightly used stations have been closed, there is better coordination between the rapid transit system and the surface system, a skip-stop system has been installed on all major routes, and speeds of rapid transit lines are higher than ever before in the history of Chicago's transportation system. Today speeds average over 20 miles per hour on most rapid transit routes. The average speed on the Congress Expressway route is 25 miles per hour.

Despite these improvements, the present elevated system which predominates the rapid transit system is inherently obsolete. Elevated structures are no beauty spots, and many miles of them will remain into the indefinite future, especially on the north-south route. The cost of replacing them with subways, as has been done in New York, is prohibitive. In addition, the volume of riding on most Chicago rapid transit routes is not great enough to justify this huge cost. Most of the elevated lines in New York were replaced by subways before the Second World War, and the cost was much less than today. In addition, the elevated routes in New York were really appendages to the more important subway routes, while in Chicago the elevated are the main routes.

Chicago's rapid transit system is not well laid out. There are three routes on the west side paralleling each other for 10 miles. On the other hand, there is no rapid transit service to the densely populated outer northwest section of the city. Funtunately, this latter problem is being resolved through the extension of the Logan Square line on the northwest expressway.

Chicago's rapid transit stations are not as heavily used as those in Philadelphia or Boston, despite the fact that the latter two cities are considerably smaller than Chicago. This is largely due to the poor layout of the Chicago rapid transit system.

In addition to the rapid transit lines of the Chicago Transit Authority, there are several commuter railroads which bring 77,000 people to the Loop during the maximum hour.

Most of the commuter traffic is handled by five railroads: Illinois Central; Chicago, South Shore & South Bend; Chicago, North Shore & Milwaukee; Chicago & North Western; and the Rock Island. The first three roads are electrified overhead operations. The latter two are diesel.

The commuter railroads perform an important function in bringing suburbanites to the Loop. They bring more people to the central area of Chicago than any other form of transportation, including the local rapid transit system. As in the case of the rapid transit, maxi-

mum hour riding has increased about 9 percent from 71,000 in 1948 to 77,000 in 1957.

The most important road is the electrified Illinois Central which carries about 55,000 people a day on its 3 routes. The Illinois Central covers the very densely populated south Chicago region, and the riding pattern is more typical of a rapid transit line because midday riding is heavier than most commuter railroads. The area served by the Illinois Central is a mixture of industrial and low income residential, except for the southern parts of the routes which are average residential.

The Chicago South Shore & South Bend shares the trackage of the Illinois Central from the Loop to 115th Street on the south side of Chicago, and provides service to Indiana suburbs of Hammond, Gary, Michigan City, and others. The area served by the South Shore is highly industrialized and low-income residential.

The North Shore line serves the most desirable suburbs in Chicago on the north shore of Lake Michigan. While rush hour traffic has increased during the past 10 years, the line is now threatened by abandonment because of the poor financial condition of the railroad. However, attempts are being made to save the line, including the possible establishment of a public authority.

The Chicago & North Western and Rock Island serve average residential suburbs, mostly in the newer areas.

The equipment on the commuter railroads is generally no better than in New York. There have been a few new cars purchased by the Chicago & North Western and Rock Island; and the South Shore has extensively modernized many of its cars. But the great bulk of the equipment dates back to the 1920's, and the purchase of new equipment would help in attracting additional riders. The commuter railroads provide relatively good coverage to those areas not served by the rapid transit. Each railroad has only one station in the Loop area, except for the North Shore which shares the elevated structure of the CTA rapid transit system. Most of the commuter railroad stations are not located as conveniently to destinations as the elevated loop.

CHAPTER III

PHILADELPHIA METROPOLITAN AREA

Philadelphia, the fourth largest city in the United States, is the chief port on the Delaware River system. It is one of the oldest cities in the country and once served as the Nation's Capital. Today, Philadelphia is an important industrial center having large oil refineries, textile mills, and chemical plants. Its port has tonnage comparable to Baltimore and New Orleans.

The Philadelphia standard metropolitan area is 3,600 square miles and has a population of about 4 million, of which 2,200,000 live in the city. Although Philadelphia is a highly industrialized city, its central business district accounts for 41 percent of the total employment. About 600,000 people a day enter downtown Philadelphia. Most of them work there, many in large office buildings including the new Penn Center project. Penn Center is an extensive downtown redevelopment plan which includes a large number of new office buildings, a new bus terminal, a new hotel, and other improvements.

Philadelphia's central area is built on an obsolete gridiron street pattern. With the exception of a few major arteries such as Broad and Market Streets, all of the streets are extremely narrow and congested, and unable to carry any great volumes of traffic. It is with this background that an analysis will be made of rapid transit facilities in Philadelphia.

Of the 600,000 people who enter downtown Philadelphia on an average weekday, 340,000 or 57 percent enter by public transportation (including commuter railroad). However, during rush hours, 75 percent enter by public transit.

To bring this large number of people downtown there exist two basic rapid transit systems. The first is the subway and elevated lines operated by the Philadelphia Transportation Co. The second is the commuter railroad system operated by the Pennsylvania and Reading Railroads.

The Philadelphia Transportation Co. is the primary operator of mass transit in the Philadelphia area. Although it is a privately owned company, most of the rapid transit facilities which the company operates are owned by the city of Philadelphia or the Delaware River Port Authority. The history of this unique arrangement goes back to 1907 when the old Philadelphia Rapid Transit Co. completed building the Market Street elevated-subway. This was a unique situation because it represented one of the few cases where a private company spent its own capital funds for constructing a rapid transit line. The company, however, ran out of funds to build additional rapid transit lines. The northeast part of the city was growing very rapidly after 1910 and it became urgent to provide rapid transit service to this area. Thus the city of Philadelphia undertook to construct the

Frankford elevated. Upon the completion of the Frankford elevated in 1922, the Market Street subway-elevated and Frankford elevated were merged into one Market-Frankford route. In later years, the city built the Board Street subway, the Ridge Avenue subway, the Locust Street subway, the Market Street subway extension (to replace a portion of the Market elevated), and the Market Street subway-surface extension. The Delaware River Joint Commission, later replaced by the Delaware River Port Authority, completed a high-speed rail line to Camden in 1936.

Today the Philadelphia rapid transit network comprises 27 miles of route. The Philadelphia Transportation Co., operator of the mass transit facilities in Philadelphia, leases the publicly owned facilities from the city of Philadelphia and Delaware River Port Authority. This arrangement has proven to be very unsatisfactory, as will be explained later. About 2 million people ride PTC each weekday. Of these, 570,000 are carried on rapid transit and subway-surface routes. To carry this large number of people requires the operation of some 2,640 pieces of equipment, including 541 rapid transit cars, about 1,400 motorbuses, 500 PCC streetcars, and 200 trolley coaches. Of the 500 streetcars, about 150 are used for subway-surface operation.

The rapid transit system is well integrated with the surface system. Unlike Chicago, the rapid transit facilities in Philadelphia have always been operated on a unified basis. However, rapid transit equipment in Philadelphia is not nearly as modern as in Chicago. There have been no new rapid transit cars added to the system in 20 years.

Following is a brief description of the rapid transit lines in Philadelphia:

Market-Frankford subway-elevated.—This is the principal transit route in Philadelphia, carrying about 250,000 people a day and measuring 13 miles in length. The number of passengers is now evenly divided between the Market and Frankford ends of the route. Service is provided with six-car trains every 2 minutes in the rush hours. An "A" and "B" skip-stop system, similar to that in Chicago, is operated on this route during the rush hours, although it is not as successful as in Chicago because of the obsolete equipment. There are 315 rapid transit cars assigned to the route, most of which date back to 1907, and all of which are in deplorable condition. A bond issue has been approved by the voters to purchase 270 new cars to replace the entire equipment on this route, and modernization should be completed by the fall of 1960. The new cars will reduce the one-way travel time from 45 to 35 minutes, and increase the average speed from 17 to 22 miles per hour. The close distances between stations—one-half mile outside the central area—will not permit any greater speed. The route operates from the 69th Street terminal (an important transfer point for connecting suburban rail and bus feeders to the west) on a surface right-of-way to 63d Street, where the line enters the elevated structure over Market Street. The route is elevated to 44th Street, entering the subway under Market Street and remaining underground through the central area, and emerging on an elevated structure on Front Street at the waterfront area. The remainder of the route to Bridge Street terminal in Frankford is elevated structure. The Market-Frankford route serves older neighborhoods. The

terminals at 69th Street and Bridge Street connect with feeder lines serving the newer suburban communities.

Broad Street subway.—This is the basic north-south route, measuring 8.5 miles and carrying 200,000 people a day. Service is operated during the rush hours at intervals of 2½ minutes with six-car trains. The Broad Street subway was opened in sections between 1928 and 1938, and hence the equipment used is much better than on Market-Frankford. All of the route is underground except for a few hundred feet at Fern Rock terminal (a station added in 1956 in the subway shop property). The route serves established areas, except at the Fern Rock terminal to the north, which is newer residential. The subway was built for four tracks, but work only recently began on adding the two express tracks. Express service began in September 1959 and has reduced traveling time between Fern Rock and the central business district by a few minutes. In connection with the Broad Street subway, there is a 1-mile spur subway extending diagonally under Ridge Avenue between Broad Street and Eighth Street. This spur serves as an alternative route for Broad Street subway riders to reach the Eighth and Market shopping area.

Locust-Camden.—This rapid transit route, which is owned by the Delaware River Port Authority, connects downtown Camden with downtown Philadelphia. The 3.6 mile route is underground, except for the portion on the Benjamin Franklin Bridge over the Delaware River. About 20,000 people a day use this route, representing a 50 percent decline since 1948. Service is rather infrequent by rapid transit standards, ranging from three- and four-car trains every 5 minutes in the rush hours to a single car every 10 minutes in the middle of the day. Service from Eighth and Market to Camden began in 1936, and the connecting Locust Street subway in downtown Philadelphia was completed in 1953. The line has been a disappointment since the day it opened. It does not serve the newer communities in New Jersey, but merely connects the decaying heart of Camden with downtown Philadelphia. At the Camden terminal connections are made with the few remaining commuter trains of the Pennsylvania-Reading Seashore Lines. Many plans have been presented during the last 35 years for extending rapid transit to south Jersey by utilizing the trackage or the right-of-way of the seashore lines, but no concrete action has ever been taken. It was hoped that when the Locust Street subway was completed there would be an improvement in riding, but this never came about. This subway was completed in 1936, but it remained a hole in the ground until 1951 when tracks and signals were installed. Locust Street is a very minor street just south of the main business section, and is not conveniently located for downtown destinations; hence, people ignore it. Unless extensions into south Jersey are forthcoming, the Locust-Camden line will remain a short shuttle.

Market Street subway-surface.—The Market Street subway-surface is basically an adjunct to the Market Street subway-elevated and provides local subway service between downtown and West Philadelphia. Service is provided by modern streetcars on five routes, four of which go into Southwest Philadelphia, and one which goes northwesterly into Overbrook. The subway-surface system carries about 100,000 people a day, and during the rush hours there is a continuous

stream of cars. Although the equipment used in the subway-surface system is very modern, it is not being used to its maximum efficiency. All cars are run as single units, and the close frequency of service during the rush hours causes bunching of cars. This problem could be alleviated by reducing the number of car movements and installing multiple-unit couplers for train operation. The subway measures 2½ miles, and the remaining parts of four of the lines are on city streets, mostly in residential areas. The fifth route operates on private right-of-way for the outer portion in the Eastwick area. This latter route will increase in importance when the large Eastwick redevelopment project is completed. It is planned to construct a large bus and trolley terminal at this point.

The city of Philadelphia plans to start work in 1960 on extending the Broad Street subway south from its present terminal at Snyder Avenue to Pattison Avenue, a distance of 1½ miles. Here it is proposed to build a large parking lot for perhaps 2,000 cars. The proposed southern terminal is located close to the Walt Whitman Bridge, which brings in many commuters from New Jersey. It is hoped the extension of the subway and the parking facilities will encourage motorists to use rapid transit instead of driving to the center of Philadelphia. The cost of this extension will be $15 million.

A 1-mile section of the Frankford elevated will be relocated in the median strip of the proposed Delaware Expressway. This will remove a section of the unsightly elevated structure near the central business district.

It is planned to eventually integrate the Chestnut Hill branches of the Pennsylvania and Reading Railroads with the city-owned Broad Street subway to provide more frequent service and better distribution.

Parking facilities are presently available at 69th Street, Bridge Street, Fern Rock, and few intermediate stations on the Broad Street subway. In addition to the large lot planned at Pattison Avenue, it is expected that a parking lot will be constructed at the subway portal of the subway-surface lines at 40th Street and Woodland Avenue.

The commuter railroad network is much less complex in Philadelphia than in either New York or Chicago. Nevertheless, the Pennsylvania and Reading Railroads perform an important function in carrying 100,000 people a day.

The Pennsylvania, which carries 60,000 people a day, operates electrified commuter service from Suburban Station in downtown Philadelphia to outlying suburbs of Trenton, Chestnut Hill, Norristown, Paoli, West Chester, and Wilmington. The most important of these routes is the western Paoli line, which serves 17 stations on the famous Main Line. The Pennsylvania suffers from the same conditions as most other commuter railroads—the great bulk of its business is during the morning and evening peak hours, and very little during the rest of the day. The equipment operated is basically inefficient and expensive to run. Most of the cars are more than 30 years old, are very heavy, and consume much electricity. They are also very slow in accelerating. Modern lightweight equipment, similar to that on order for the Market-Frankford rapid transit, would do much to

reduce operating costs and improve riding qualities. Frequency of service ranges from a train every 2 hours in the middle of the day to every 15 minutes during the rush hours. Trains vary from 2 cars in the base period to 10 and 11 cars in the rush hours.

The Reading Co., which handles 40,000 riders a day, operates electric trains from Reading Terminal in downtown Philadelphia to suburban communities of Chestnut Hill, Hatboro, Lansdale, and Norristown. The frequency of service is about the same as on the Pennsylvania. The equipment is somewhat better.

The areas served by the commuter lines are largely suburban residential. There have been substantial population increases along these routes, and rush-hour riding is greater than before the war. Virtually all of the riding is downtown oriented.

The following table gives a breakdown of the peak period riding volume of rapid transit lines and commuter railroads in Philadelphia in 1959:

	Maximum p.m. peak volume	Total weekday average
Market-Frankford subway-elevated	20,000 east 20,000 west	250,000
Broad St. subway (includes Ridge link)	20,000 north 10,000 south	200,000
Locust-Camden	14,000 east	20,000
Market St. subway-surface	10,000 west	100,000
Pennsylvania suburban trains	15,000 west	60,000
Reading suburban trains	9,000 north	40,000
Total		670,000

Source: E. L. Tennyson, transit engineer, city of Philadelphia.

The city of Philadelphia, in cooperation with the Pennsylvania Railroad, the Reading Railroad, and the Philadelphia Transportation Co., undertook a unique experiment which involved increasing the service on the two railroads' lines to Chestnut Hill and permitting transferring to buses and streetcars of the Philadelphia Transportation Co. This experiment became officially known as Operation Northwest. The Chestnut Hill lines were chosen because they lie entirely within the city of Philadelphia. A sum of $160,000 was set aside to subsidize the two railroads for the increased service for a period of 6 months, which began on October 26, 1958. Under this arrangement, fares were reduced to 30 cents one way between downtown Philadelphia and any point on the lines. For an additional 10 cents it is possible to transfer from the trains to a bus or streetcar line at four stations of the Pennsylvania and four stations on the Reading. In order to increase the attractiveness of this service, rush hour frequency has been increased to every 15 minutes and midday service boosted to every 30 minutes.

The experiment has been considered a moderate success. The increase in service and reduction in fares is a great improvement of the previous service. However, the bus transfers have been very disappointing—all of the surface lines connecting with the railroads also connect with the Broad Street subway, which has a 2½ minute service in the rush hours. Most passengers prefer to transfer from the subway because the waiting time is much less. Also, it is rather difficult to schedule good feeder connections with the trains in rush

hours because of street congestion. There has been a 15-percent increase in railroad travel on the two lines due to the increased service and reduction in fares. Most of these riders formerly drove downtown. However, they represent less than a thousand people a day. Hence this experiment cannot be expected to substantially reduce traffic congestion. What is urgently needed is more parking space at stations. At the present time there is very little.

One other major fault is the lack of distribution in the downtown area. Unless one's destination is near Suburban Station or Reading Terminal, the railroad service is not convenient because transferring is not permitted between trains and buses in the downtown area.

In addition to the rapid transit and commuter railroad lines, there is a network of high-speed rail lines operated by the privately owned Philadelphia Suburban Transportation Co. from 69th Street terminal (western end of the Market-Frankford rapid transit) to Norristown, Ardmore, Media, and Sharon Hill. These rail lines are feeders to the Market Street subway and carry about 32,000 people a day. The routes of the Ardmore, Media, and Sharon Hill lines are located on private rights-of-way with numerous grade crossings, although there is some street running near the outer terminals. The Norristown line is on private right-of-way, exclusively, and has no grade crossings, making it an ultra-high-speed operation. Frequency of service ranges from a car every 15 minutes during the middle of the day to every 5 minutes in the rush hours with single and two-car trains. During the past year there has been a slight increase of riding, and new equipment on the connecting Market-Frankford route should stimulate further growth in patronage.

The area served by the Philadelphia Suburban Transportation Co.'s rail lines has developed extensively since the end of the war. Many new homes and apartments have been built adjacent to the rail lines and parking facilities have been provided at a number of stations on the Norristown and Media lines (the backbone of this suburban system).

In evaluating transit in Philadelphia, the mere existence of rapid transit has been a blessing to the city. It is almost inconceivable to imagine Philadelphia's narrow downtown streets carrying the traffic which would exist in the absence of rapid transit. Vast street widening projects, parking areas, and expressways would be necessary to handle such traffic. Furthermore, it is almost certain that decentralization would be a far greater problem than it actually is. Downtown Philadelphia is still the heart of the city in a business, social, and cultural sense. To the extent that downtown Philadelphia is still a growing and improving area, as witnessed by the Penn Center and Independence Mall projects, rapid transit and commuter railroads are responsible to a major degree.

To illustrate the importance of rapid transit in Philadelphia, the number of people brought into center city daily on the new multimillion-dollar Schuylkill Expressway is less than the number brought in by subway in 20 minutes during the morning peak.

The layout of the rapid transit system in Philadelphia is quite good. The only major area lacking rapid transit or commuter railroads is the outer northeast. The northeast has developed in recent years, and although not as strongly oriented to the central business

district, it should receive a rapid transit route. Plans are being formulated for establishing a rail line to this growing area by utilizing the center mall of a proposed new thoroughfare to be known as Northeast Avenue. The new route would connect with the Broad Street subway in North Philadelphia, and operate as a spur of the Broad Street subway system.

Despite the rather good coverage, both the rapid transit and commuter railroad systems require extensive modernization to increase their efficiency.

CHAPTER IV

BOSTON METROPOLITAN AREA

Boston is the chief city in New England and the largest State capital in the United States. It is rapidly changing to a predominantly commercial city, as many of the industries are moving out of the congested center city, and large office developments such as Prudential Center and Government Center are replacing the industries.

The Boston standard metropolitan area is 836 square miles and has a population of about 2,500,000. The city of Boston, with a population of about 800,000, represents only 32 percent of the metropolitan area's population.

Boston has many historical landmarks, such as the Boston Common, Bunker Hill, Charlestown, and others. It is also its history which was responsible for the early construction of rapid transit facilities, as Boston has some of the narrowest streets in the country.

As is the case with all rapid transit systems in North America, with the exception of the New York subways, most rapid transit travel is oriented to the central business district. Of the 560,000 people who enter central Boston on a typical weekday, 240,000 or 43 percent enter by rapid transit or commuter railroad. However, during the rush hours when 140,000 people enter the central area, 98,000 or 70 percent enter by transit. It is the rush hour which must be considered in analyzing the value of rapid transit because it is during this period that its absence would be most noticeable.

Most of the transit service in Boston is handled by the Metropolitan Transit Authority, a public authority created by the Massachusetts Legislature to provide public transportation in the Boston metropolitan area.

The Metropolitan Transit Authority took over the functions of the privately owned Boston Elevated Railway Co. in 1947 as a result of financial problems of the company. The MTA has taxing powers, and assesses each municipality under its jurisdiction for a proportional share of the annual deficit. The following communities are served by the MTA:

Population (1950)

Boston	801,000	Medford	66,000
Arlington	44,000	Milton	22,000
Belmont	27,000	Newton	82,000
Brookline	58,000	Revere	36,000
Cambridge	121,000	Somerville	102,000
Everett	46,000	Watertown	37,000
Malden	60,000		

The population of these 13 municipalities is about 1,500,000, and represents only 60 percent of the metropolitan area as defined by the Census Bureau. Thus there is a large portion of the area which is not served by the MTA. This factor is perhaps the most serious draw-

back of the transit system. The legislation creating the Metropolitan Transit Authority made no provision for expansion of the system into other communities. The result has been an increasingly large deficit each year. In 1958 the MTA lost $15 million. Without being able to tap the newer communities, the system is hemmed in and serves many communities which are actually declining.

The transit system carries about 800,000 passengers each weekday. The three rapid transit and five subway-trolley routes carry about 595,000. The layout of the Boston system is such that most transit travel is on the rapid transit system, with extensive transferring to connecting bus and trolley coach lines. A total of 1,600 vehicles are used to provide this service, including 325 rapid transit cars, 325 PCC streetcars, 600 motor buses and 350 trolley coaches.

Boston was the first city in North America to have a subway, the one under Tremont Street dating back to 1897. Early construction of subways became necessary because of the narrow width of downtown streets.

A brief description of the rapid transit routes will be given:

Cambridge-Dorchester.—This is the most heavily traveled route in Boston, carrying about 180,000 people a day and measuring 9 miles long. Service is provided every 3 minutes in the rush hours with four-car trains, and every 6 minutes during the base with two-car trains. The rapid transit cars on this route are the longest in the world, measuring almost 70 feet. The route operates from Harvard Square in Cambridge in subway to the Charles River, where it emerges on the Longfellow Bridge; then in subway under the central area of Boston, and in private right-of-way on an abandoned railroad line to the Ashmont terminal in Dorchester. The character of the area served by the route varies from very congested commercial along the Cambridge portion to predominantly average residential on the Dorchester section. There are 14 stations, spaced about 0.8 mile apart outside of the central area. The trip from Harvard to Dorchester take 25 minutes.

MTA operates an extension high-speed trolley line for 2.6 miles from the Ashmont terminal to Mattapan. PCC cars are used as single units every 2 minutes in the rush hours and every 10 minutes during the base. The extension trolley is entirely on private right-of-way, with two grade crossings. The area served is suburban residential. Parking lots are located at four stations, including the Mattapan terminal. There are eight stations, spaced 0.4 mile apart.

Main line elevated.—This is the basic north-south transit route in Boston, carrying about 160,000 people a day and measuring 8.5 miles. Service is provided every 3 minutes in the rush hours with six-car trains, and every 6 minutes during the base with four-car trains. The cars are much shorter than those on the Cambridge-Dorchester line. The route, which is all elevated structure over city streets except for a 1-mile subway downtown, operates between Everett on the north through the central area and south to Forest Hills. The northern portion of the route is through a very old section of Boston, including historic Charlestown. It is largely industrial. The southern portion is also through old and declining sections of Boston. There are 15 stations on the route, spaced 0.7 mile apart outside of the central area. The trip from Everett to Forest Hills takes 25 minutes.

East Boston Tunnel.—The third major rapid transit route is the East Boston Tunnel, which provides rapid transit service for 51,000 daily passengers from downtown Boston to Wonderland terminal in Revere. Service is provided every 3 minutes in rush hours with four-car trains, and every 6 minutes in the base with two-car trains. The route is 6 miles long, of which 2.5 miles is subway, and the remaining 3.5 miles private right-of-way on an abandoned railroad line. The East Boston rapid transit has had two extensions since the end of the war, and is now three times as long as it was 10 years ago. It was originally operated with trolley cars, until high-platform cars replaced them in 1924. The outer portion of the route is rather open and parallels the Atlantic Ocean to Revere Beach. In addition to Revere Beach, a number of other recreation spots are located on the route including Suffolk Downs racetrack and the Wonderland dog track. These characteristics result in considerable fluctuation of riding on this route. There are 12 stations, located 0.7 mile apart outside the central area.

Boylston-Tremont trolley subway.—This is the streetcar subway which provides local subway service in downtown Boston and the Back Bay area. There are six routes, carrying a combined total of about 225,000 people a day. These routes, which are operated exclusively with modern streetcars, run underground through downtown and emerge on the surface for the outer portions. In addition, there is a connection with a long elevated structure to Cambridge. Two of the routes operate on this elevated, then downtown in the subway, and emerging on reserved rights-of-way on two major streets (Beacon Street and Commonwealth Avenue) through fine apartment districts. These two routes use three-car trains in the rush hours. Two other routes use two-car trains, but operate entirely on city streets through older residential areas. The fifth route is a minor line running single cars on a narrow street for about a mile outside of downtown. During the rush hours there is a continuous stream of one-, two-, and three-car trains passing Park Street Station, focal point of the subway-trolley system. The five previously existing lines were joined by a sixth route on July 4, 1959, when the new Riverside line began operation.

The MTA completed construction of a new rapid transit line to suburban Brookline and Newton which utilizes the tracks of the abandoned Highland Park branch of the Boston & Albany Railroad between a connection near Kenmore Station on the Boylston Street subway, and Riverside at the western extreme of Newton. The new rapid transit extension, which measures 9.4 miles, provides fast service to two residential communities which have a combined population of over 140,000. The route is the longest on the MTA system, measuring about 12 miles from the Riverside terminal in Newton to Park Street Station in downtown Boston. Equipment consists of modern streetcars operated in multiple units. Service consists of three-car trains every 5½ minutes during rush hours to Riverside. During offpeak hours, three-car trains run every 10 minutes. The Riverside terminal is situated in the middle of a parking lot for 2,000 automobiles. It is located adjacent to circumferential Route 128 and near the eastern terminus of the Massachusetts Turnpike. Roads connect Route 128 and the turnpike with the parking lot. In addition, there are smaller

parking lots at several stations. Fares are collected on the cars. There are no fare collection facilities at the stations on this route (except at the subway stations where fares are collected by cashiers). The rapid transit route is ultimately expected to carry about 35,000 people a day. Cost of the improvement is $11 million, or a little more than $1 million a mile. The most expensive part of the extension is the short subway connection between the railroad line and the streetcar subway near Kenmore. Other construction work included rehabilitation of the railroad with new ties and rails; a completely new signaling system; a new substation; electrification of the entire route with overhead trolley wire; construction of yard facilities at Riverside and enlargement of those at Reservoir; parking facilities at stations, including the very large lot at Riverside; connecting roads with Route 128 to the parking lot at Riverside; and installation of multiple-unit equipment on a number of streetcars. The new Riverside line provides MTA service to a large area which previously had virtually no public transportation. It is the first instance in many years in which the transit operations are being extended into newer areas.

MTA has established a number of parking lots at many rapid transit stations, especially the terminals. These parking lots have been quite successful in reducing the number of automobiles entering downtown Boston, even though a 35-cent charge is made for parking. However, most of the parking lots are rather small and more space is needed.

The following table gives a breakdown of the approximate peak period riding volume of rapid transit lines in Boston in 1959:

	Maximum p.m. peak volume	Total weekday average
Cambridge-Dorchester	18,000 east 18,000 west	180,000
Main line elevated	16,000 north 16,000 south	160,000
East Boston Tunnel	10,000 north	51,000
Boylston streetcar-subway (includes 6 routes)	12,000 east 16,000 west	225,000
Total		616,000

Source: Metropolitan Transit Authority.

In addition to the Metropolitan Transit Authority, there are three railroads which provide commuter service in the Boston area: the Boston & Maine to the north; the New York, New Haven & Hartford to the south; and the Boston & Albany to the west. Virtually all of the service is confined to rush hours. Because of the plight of the New England railroads in recent years, there has been a substantial reduction in service, including the complete elimination of certain branch lines. From time to time it has been proposed that certain of these routes, especially those in the more densely populated suburbs, be taken over by the MTA and integrated into their system. Such an example has taken place on the Riverside line, and it appears likely that the Old Colony division of the New Haven will also be integrated into the MTA system in the near future. Such integration has the advantage of providing much better distribution for pas-

sengers because the commuter roads generally have only one station in the downtown area. It would also permit transferring to other transit routes to reach destinations outside of downtown. If the commuter railroads continue to reduce their service, it seems reasonable to predict that eventually the MTA will take over most of their service.

CHAPTER V

CLEVELAND METROPOLITAN AREA

Cleveland was named after Gen. Moses Cleaveland, the head surveyor of a private land company, which undertook the settlement of the area after the Revolutionary War. Known as the "best location in the Nation" Cleveland stretches out for nearly 30 miles along the shore of Lake Erie and 10 miles inland. The Cleveland standard metropolitan area is 688 square miles and has a population of about 1,700,000, of which 950,000 live in the city. Most of Cleveland is on a level plain, but some of the suburbs away from the lake are on land 100 to 300 feet higher. The half-mile wide, low, flat valley of the Cuyahoga River in the center of the city is filled with steel mills, lumber yards, oil refineries, and other heavy industry.

Because Cleveland is basically a heavy industry city, its downtown working population is not as great as that of commercial cities such as Boston or San Francisco. However, according to a recent survey an estimated 285,000 persons enter downtown Cleveland on an average weekday.

Of the 285,000 people entering downtown Cleveland each weekday, 153,000 or 53 percent enter by automobile, and 132,000 or 47 percent come by public transit. Of those using public transportation, an estimated 20 percent come by the rapid transit facilities of the Cleveland Transit System and the city of Shaker Heights.

The most important public transit system in Cleveland is the municipally owned Cleveland Transit System. It is considered by many to be the most efficiently operated municipal transit system in the United States. The Cleveland Transit System has been fortunate in having had a smaller decline in riding than most other cities because of the high quality of service that has prevailed. Donald C. Hyde, general manager, believes that speed is the primary element in holding onto transit patronage and attracting new riders. Since 1946, the system has inaugurated fast express buses on 23 routes radiating in all directions from downtown Cleveland, and they provided reasonably good service until most of the lines were replaced by a rail rapid transit route 4 years ago.

The Cleveland Transit System operates 88 rapid transit cars, about 900 motorbuses and 250 trolley coaches, or a total of almost 1,240 vehicles. About 700,000 passengers are carried on an average weekday, including 60,000 rapid transit riders.

Although the CTS rapid transit has been in operation only 4 years, its history goes back about 40 years when the Van Sweringen brothers built their railroad and real estate empire, and saw the need for fast public transportation to keep pace with the rapidly expanding Cleveland area. The two brothers were struck by the idea that the natural ravine used by their railroads would also make an ideal right-of-way for a rapid transit line. When the Cleveland Union Terminal was

built in the 1920's, provisions for a rapid transit terminal were incorporated. Considerable work was done on the physical construction of the rapid transit, including grading, catenary towers, and bridges, but the depression of 1929 resulted in the crash of the Van Sweringen empire and the old right-of-way was abandoned. It lay unused for some 30 years, but finally traffic congestion grew severe enough to revive the subject of using it again. In 1949 the voters of Cleveland approved a charter amendment authorizing the Cleveland Transit System to borrow $29,500,000 from the Reconstruction Finance Corporation to construct the rapid transit. Ground was broken on February 4, 1952, and operation started on the East Side line on March 15, 1955, followed by the West Side line to West 117th Street on August 14, 1955, and the West Side extension to West Park on November 15, 1958. The total cost of the rapid route including cars and shops was about $37 million.

The CTS Rapid, as the route is commonly called, is a 15-mile rail line extending from Windermere terminal in East Cleveland (8 miles from downtown) to West Park terminal in the western part of Cleveland (7 miles from downtown). There are 14 stations, spaced an average of 1.2 miles apart. The CTS Rapid is more of a commuter railroad than a heavy duty subway because of a very great peak-hour volume and relatively light base, and the long distances between stations. Due to the latter factor, this rapid is the fastest on the continent, averaging 30 miles per hour. The 15-mile trip from Windermere to West Park takes only 30 minutes (16 minutes from downtown to Windermere, and 14 minutes from downtown to West Park).

Unfortunately, the rapid transit suffers from the existence of only one station in the downtown area, that being located at the Cleveland Union Terminal. This is the major reason why only 20 percent of the people entering downtown on transit use rapid transit. Improved downtown distribution would result in a substantial increase in its use. If a proposed downtown distribution subway were to be constructed, it is estimated that the number of daily riders would increase from the present 60,000 to over 100,000. A large proportion of the downtown working population is too far away from the Union Terminal, and hence depend on surface buses or automobiles. A downtown distribution subway was approved by the voters of Cuyahoga County in 1953 by an overwhelming majority, but construction has been delayed by failure of the county commissioners to approve actual work on the $35 million project.

Service on the rapid transit is provided by high-level platform cars which are operated in trains of one to six units. During rush hours, four- and six-car trains are operated every 2½ minutes on the West Side line, and four-car trains on the East Side line every 5 minutes. Although through service is operated from east to west, every other West Side rush-hour train terminates at Union Terminal, because the peak-hour volume on the West Side is much heavier than on the East Side. Probably the most important reason for this is that the western section of the line penetrates the heart of that part of the city, while the eastern service is for at least half its route in an area of industry and railroad yards, not returning to the heavier populated areas until University-Cedar station is reached. Another reason is that West Siders are traditionally used to Public Square downtown delivery,

while East Siders have always had direct service to the upper downtown shopping and amusements (centering around East Ninth and Euclid) without change. For many of these people (especially those from Cleveland Heights) rapid transit would just add to the time of the journey since they would have to backtrack from Public Square. Certain express buses, especially from Cleveland Heights, have been retained to accommodate passengers wishing delivery to the upper downtown area. Express service is operated on certain trips on the West Side rapid transit during the rush hours between union terminal and West 117th Street, a distance of 5 miles. The express service is operated on the same tracks as the local service, there being only one track in each direction, and is made possible by scheduling express trains to depart 1 minute before the local, and arriving at the western terminal just behind the preceding local train. Although only 1 or 2 minutes are saved, the express operation has a tremendous psychological impact because it gives riders the illusion of speed. As a matter of fact, there are some riders who will let a local train pass by and wait for the express, even though it is impossible for the express to get ahead of the local.

Fringe parking at rapid transit stations has been helpful in attracting riders. About 5,000 parking spaces are available at seven stations, more parking than any other rapid transit city. Most of the parking areas on the West Side are filled to capacity by 8 o'clock in the morning.

Although the rapid transit route is primarily oriented to downtown, about 30 percent of the riders are through riders traveling from west to east, or vice versa.

Feeder buses are very important in making the rapid transit successful, because the distance between stations is too great to allow much walk traffic. They also act as extension routes to tap those areas not directly served by the rapid transit. Aside from the Union Terminal, the Windermere terminal on the East Side and the West Park terminal on the West Side are the most important stations on the line, and elaborate transfer facilities are provided. Feeder bus connections are arranged so that buses connect with specific trains during the off-peak hours when frequency of service is not as great. This reduces the time required for transferring from train to bus.

An interesting feature of the CTS Rapid is the so-called "kissing loop." This is a loop area inside the rapid transit station which makes it possible for the wife to drive her husband to a rapid transit station, kiss him goodby, and drive home while he boards a train for his downtown office. This arrangement is working out quite well, as evidenced by the long row of cars waiting to get inside the loop area during the morning and evening rush hours. It provides the transit system the economy of reducing the feeder bus demand, which is very expensive to provide, and also reduces the amount of parking required at stations.

Riding on the rapid transit has been increasing since it opened 4 years ago. From an average of 36,000 a day in 1955, riding has increased to an average of 60,000 in 1959.

One important indication of the healthy patronage of the CTS Rapid is the small number of public service car cards which are found inside the vehicles. With the large decline in surface transit riding all over the country, transit advertising has become less attractive to

advertisers, and many vehicles have large empty spaces or unpaid public service ads. This is not true for rapid transit cars in Cleveland. Instead of the usual "Join the Navy" or "Fight Forest Fires," rapid transit cars sport advertisements by stockbrokers, opera, ballet, and fine restaurants.

The CTS Rapid is built entirely on a railroad right-of-way. The East Side line is left-side operation, similar to that in England, while the West Side is the more conventional right-hand operation. The layout of the Cleveland Union Terminal is responsible for this arrangement.

Cleveland Transit System would like to build a spur of the East Side line to the populous suburb of Cleveland Heights. The 2½-mile extension would utilize the right-of-way of a streetcar line abandoned in 1949. Extension to the Heights would provide fast service to an area very strongly oriented to the central business district, and eliminate an awkward transfer arrangement to feeder buses at University-Cedar Station.

The City of Shaker Heights, a wealthy suburb to the east of Cleveland, also operates a rapid transit system. It consists of two divisions—the more densely populated Van Aken division and the Shaker Boulevard division.

Shaker Heights is truly "the town that transit built." It was part of a land speculation by the Van Sweringens. In developing their community, they decided that an ordinary trolley line would not encourage settlement. They therefore designed a rapid transit line direct to Cleveland Union Terminal. When the lines were built in 1920, there were only 3,000 people living in Shaker Heights. Today there are about 40,000 people, many of whom depend on the rapid transit. The entire city is extremely beautiful. It is a strictly zoned independent municipality made up entirely of private homes of a comparatively expensive type, apartment houses, and a few selected shopping centers, together with a liberal sprinkling of country clubs and nationally known private schools.

The Shaker rapid transit became municipally owned in 1944, when the city purchased the route from the banks which held it since the Van Sweringen Co. went into receivership during the depression.

Shaker Heights has many two-car families, but ironically that has helped the rapid transit because it permits motorists to provide their own feeder service to rapid transit stops. Parking spaces are provided along many stations, and the Green Road terminal of the Shaker Boulevard division has space for over 600 cars. All parking spaces are usually filled to capacity on weekdays.

The two divisions of the rapid transit carry about 20,000 people each weekday, about twice the number carried in 1940. Equipment includes 55 modern trolley cars operated in one, two, three and four-car trains. Service is three and four-car trains every 3 minutes in rush hours, and a single car on Van Aken every 15 minutes and every 30 minutes on Shaker Boulevard.

The rapid lines operate from Union Terminal along the Nickel Plate Railroad right-of-way, part of it left handed, and sharing the trackage of the CTS Rapid as far as East 55th Street. Between Union Terminal and Shaker Square, 6 miles away, there are no grade crossings. At Shaker Square the two divisions branch out. The lesser

traveled Shaker Boulevard line continues straight east for another 4 miles, serving a low density area consisting of large mansions valued at up to $75,000 each, to a terminal at Green Road. The more important Van Aken division turns southeasterly for 3 miles to a terminal at Van Aken and Kinsman. The routes of both divisions east of Shaker Square are along the center mall of two important boulevards in Shaker Heights, with some grade crossings.

The traveling time from the terminals of both divisions to Union Terminal is 23 minutes. Although the Shaker Boulevard division is 1 mile longer than Van Aken, the stations are farther apart. Between Shaker Square and Union Terminal, the 6 mile trip takes only 10 minutes. During rush hours, express service is provided making no stops between Shaker Square and Union Terminal.

The city of Shaker Heights operates only the two rapid transit lines. There are no feeder buses, and this is one drawback to the system.

Though the volume of riding is not exceptionally heavy, the line does have great prestige because of the area it serves. The Shaker rapid transit is much better known throughout the country than the CTS Rapid. The Shaker rapid has stimulated land development along its tracks, and many people are willing to pay a premium price to live near the right-of-way.

The following table gives a breakdown of the peak period riding volume of rapid transit lines in Cleveland in 1959:

	Maximum p.m. peak volume	Total weekday average
CTS East-West Rapid Transit	10,000 west 4,000 east	60,000
Shaker Heights Rapid Transit (both divisions)	4,000 east	20,000
Total		80,000

In conclusion, it can be stated that rapid transit is providing a useful service to those areas oriented to the central business district. However, since Cleveland is an industrial city with most employment outside of downtown, rapid transit will probably never achieve the importance of New York, Boston, or Toronto.

CHAPTER VI

METROPOLITAN TORONTO

Toronto, capital of the Province of Ontario, is situated on the north shore of Lake Ontario almost opposite the mouth of the Niagara River. It is Canada's greatest commercial center as well as the cultural center of English-speaking Canada. The city is well known for being the first to adopt a completely federated metropolitan government in North America. Although other cities have adopted some phases of metropolitan government, the Toronto plan is still considered by many to be the most successful. The population of the 240-square mile federated municipality of Metropolitan Toronto is about 1,500,000.

Toronto and its suburbs sprawl east and west along 25 miles of lakeshore, whereas its greatest north and south depth is around 10 miles.

The municipality of Metropolitan Toronto is made up of the city of Toronto and 12 adjoining municipalities. Most of the employment is in downtown Toronto, and over 500,000 people enter the central business district on an average weekday. The city is in a boom stage and many new office buildings are going up. Toronto is one of the few American cities where the central business district has not shown a decline, but has actually increased in value. With this type of business activity, it is easy to understand why rapid transit has been so successful in this Canadian city.

Public transportation has been publicly owned in Toronto since 1921 when the Toronto Transportation Commission was established, whose operations were confined to the city of Toronto. With the formation of the municipality of Metropolitan Toronto on January 1, 1954, the Toronto Transit Commission was established to assume all the duties and obligations of its predecessor, the Toronto Transportation Commission. At the same time the financial responsibility of the commission, which previously extended for an area of 35 square miles, was enlarged to cover the metropolitan area of 240 square miles. The Toronto Transit Commission consists of five members, all of whom are residents of Metropolitan Toronto. They are appointed by the metropolitan council for terms of 5 years and salaries of the commissioners are fixed by the council.

The Toronto Transit Commission, which has a monopoly on transit operations in Metropolitan Toronto, carries about 950,000 passengers each weekday. Equipment includes 877 streetcars (including 744 PCC cars), 493 motor buses, 140 subway cars, and 140 electric trolley coaches—a total of 1,650 vehicles. The TCC also operates ferryboats to the adjoining Toronto Islands, a rather unique service for a transit system. Fares are based on a zone system. The first zone, which includes the entire city of Toronto plus some nearby suburbs to the northeast and northwest, is 15 cents cash, or 4 tickets for 50 cents.

Zone 2, which extends for 4 miles, is the same fare as zone 1. Subsequent zones, which are shorter in length, are 10 cents for each zone.

The Toronto Transit Commission began operation of a 4.6-mile subway under Yonge Street, the city's main north-south artery, on March 30, 1954. The subway was built to replace the Yonge streetcar line, which had the reputation of being the most heavily traveled streetcar line in the world. The subway carries about 250,000 people each weekday. The designed capacity of the subway was 40,000 passengers per hour, but it was not anticipated that this volume would be reached until after 1960. Already, however, the rush hour traffic has reached a rate of 39,000 passengers per hour for a 15-minute period, and it has been necessary to increase the length of trains from six cars to eight cars. This required increasing the subway car fleet from 106 to 140 cars. Service is provided at 2-minute intervals in rush hours and 3- to 4-minute intervals in the midday. The subway makes connections with over 30 streetcar, bus, and trolley coach lines. There are 12 stations, spaced about one-third mile apart. Excellent arrangements have been made for easy physical transfer from rapid transit to surface vehicles at the various stations along the line, and at all stations outside of the central business district passengers transfer without the use of transfer tickets.

The Yonge Street subway is a north-south route running from Union Station in downtown Toronto to Eglinton terminal in the north corridor of the city. About one-half of the route is underground cut-and-cover subway, and the other half is in a depressed cut a few hundred feet either side of Yonge Street.

Use of the subway has exceeded all expectations. Riding has increased from a daily average of 225,000 in 1954 to 250,000 in 1958. The continued increase in passenger traffic has made a fourth escalator at the Eglinton terminal necessary. Checks recently completed show almost 14,000 more people used this station each day in 1958 than in 1957. Now, on an average weekday, 106,000 transit riders are using Eglinton. In the peak hour 15,000 passengers travel in the rush hour direction and at the same time another 2,000 to 3,000 pass through the terminal in the opposite direction. In the evening rush hour, traffic is up almost 5,000 an hour over 1957. Most of this increase is the result of the recent completion of Eglinton Avenue East (a major east-west arterial street) and the simultaneous inauguration of the Eglinton East express bus service. The new route has provided large areas of North York, East York, and Scarborough with fast, convenient and direct service to the subway, and is an excellent example of how the subway benefits suburban riders. The traveling time from Eglinton to Union Station is 16 minutes.

The subway has had a startling effect on real estate development. Values within two blocks of the subway have jumped three to seven times their former value. Assessments in subdivisions of the city adjacent to the subway have gone up about 31 percent as compared to only 17 percent in other sections. The increased taxes already exceed the fixed charges on the subway by more than one-third.

The subway has pioneered a building boom along the route. New office buildings are being erected on most of the vacant land or as replacements for former old buildings razed to provide space for the new. Apartment houses are being erected either close to the route or

within walking distance of it. A group of insurance firms have erected or enlarged their offices on one of the main cross streets, also within walking distance. Parking lots have been built over some of the open cut sections and buildings are being considered also. And some areas which could properly be described as blighted were renovated.

The subway, which cost $68 million, was paid for entirely out of funds of the Toronto Transportation Commission from earnings during the Second World War. No taxes were used to finance this project. However, this method of financing will change drastically with the construction of a new 10-mile east-west subway now underway. How this large capital improvement will be financed will be described later.

The overwhelming results of the Yonge Street subway have necessitated immediate construction of an east-west subway under Bloor Street, as well as a short north-south subway under University Avenue from Union Station to Bloor Street.

The University-Bloor subway will be one of the largest public works projects ever to be undertaken in Canada. The project, which is to be carried out in three stages over the next 10 years, will cost $200 million. The first phase will be the 2-mile University Avenue subway (parallel to Yonge Street three blocks west) extending from the south end of Yonge at Union Station west on Front Street and north on University Avenue to Bloor. There are six stations in this section, which is expected to be completed in early 1963. The second stage will be the east leg on Bloor Street and Danforth Avenue from University and Bloor to Greenwood and Danforth, including the construction of Greenwood Yard and Shops. There are eight stations on this portion of the line, and completion is expected in early 1967. The final stage, expected to be completed in late 1969, will be the west leg on Bloor Street from University to Keele, and extension of the east leg from Greenwood to Woodbine. There will be 10 stations on this last part.

When completed, Toronto's new subway will be 10 miles long, have 25 stations, and will carry about 345,000 passengers a day, a volume which is greater than any rapid transit line in North America outside New York City. Construction will include 8 miles of cut-and-cover subway, 1½ miles of tunneling subway, and one-half mile of open cut. With the exception of two short sections, one at Keele Street and the other at the Rosedale Ravine, the line will be underground at a depth averaging about 40 feet. Stations will average 2,000 feet apart, and speeds including stops will be 20 miles per hour.

Toronto needs additional subways because its streetcar lines are among the most heavily traveled in the world. The streetcar line on Bloor Street, which will be replaced by the new subway, carries 200,000 people a day. The daily mounting difficulties of operating surface transit on increasingly congested streets will make it impractical to operate streetcars in Toronto beyond 20 years. Buses do not have the capacity to carry the loads which are being handled by the main streetcar lines. Thus, the problem now facing Metropolitan Toronto is not merely that of building an additional subway line, but that of devising an entirely new system, consisting mainly of a few rapid transit lines supplemented by feeder buslines.

The cost of the new subway will be shared by the metropolitan corporation and the Toronto Transit Commission, with Metro assuming 55 percent and the TTC assuming 45 percent. Metro is levying a two mill property tax to pay for its portion, and the TTC must maintain an annual profit of $1,500,000 for an indefinite period to pay its share. To make this possible, it will probably necessitate an increase in the present 12½-cent fare in the not too distant future. Still, fares will be well below the average of 25 cents in the United States.

The aspect of the Bloor subway development which will have the most widespread repercussions is the rearrangement of the existing streetcar and bus lines into a system of feeder routes to the subway. Some 20 distinct changes are proposed in the existing system. The number of streetcars and buses entering and leaving stations of heavy concentration will be sufficient cause for extensive alteration to the streets and traffic arrangements in their vicinity. Many of the north-south streets which will serve several feeder lines each are already as congested as Bloor Street. Only 2 of the 18 north-south streets are below capacity. Therefore, it will be necessary to widen or improve the capacity of many of these streets for some considerable distance away from the subway itself. The efficiency of the feeder route streets is vital for the successful operation of the subway, as well as for traffic in general.

The Bloor-University line will stimulate development along the central part of Bloor-Danforth and accelerate the westward extension of the central business district. While the ultimate effect of the subway is to encourage development and increase land values, the process of construction temporarily disrupts land use to a greater or less extent, dependent on the type of construction. Where the line is located on private property and built in open-cut or by cut-and-cover method, as is the case on large sections of the proposed Bloor line, the properties required for construction must be bought. After completion of construction, these properties can be made available for redevelopment. Such redevelopment should make use of the new possibilities and increased land values created by the investment of public funds. In particular, the areas at the stations require careful replanning, providing on the one hand for adequate access, bus transfer facilities, and parking, and on the other, for intensive use of the land not required for these transportation facilities.

In addition to the proposed Bloor-University subway route, there is also in the mill a plan to include rapid transit in the median strip of the proposed Spadina Expressway from St. Clair Avenue to Wilson Avenue. This would include extending the University Avenue subway from Bloor Street to St. Clair Avenue, and then emerging from a portal to the median strip. This route would provide rapid transit service to an expanding area in northwest Toronto, and also alleviate future congestion on the Yonge subway above Bloor Street.

Although it was not expected that this expressway would be built for about 20 years, it has been decided to reschedule it for completion in about 8 years. Thus it appears conceivable that rapid transit service on the Spadina route could be in operation by the time the last leg of the Bloor subway is finished.

In concluding, it can be summarized that transit service in Toronto is among the best in the world. The Toronto Transit Commission

believes that spending large sums on subway construction is the only means for solving the problem of downtown congestion. Fortunately, the Metropolitan Corp. shares this view and is committing itself to spending many millions of tax dollars for transit improvements. With such a happy combination, there is no doubt that Toronto is well on its way to providing its citizens the best transportation money can buy.

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